Estimating Indirect War Deaths Directly

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There is growing interest in *non-violent deaths* caused *indirectly* by war.

It’s easy to imagine mechanisms that could transform war violence into non-violent deaths so I won’t use up any time enumerating such possibilities.

Rather, I’ll focus on statistical methods to estimate numbers of indirect non-violent war deaths.

More specifically, ***I’ll expose a flaw in how researchers estimate these numbers and propose a solution***.

OK, ready to jump in!

Actually, not yet…we're going to take a little detour first…

As a warm-up for this talk I read a bunch of papers on indirect deaths and Sustainable Development Goal 16.

I would like to offer three general observations on this discussion.

1. There is an annoying claim of dramatic improvements in our abilities to measure indirect deaths, but without actually specifying what these improvements are.

I'm, frankly, baffled by the claim – I can't think of any dramatic improvements.

2. There is a near blackout on mentions of high-profile failures of excess-death measurement, most notably by the International Rescue Committee in the Democratic Republic of Congo and by UNICEF in sanctions era Iraq.

3. There is a near-perfect blackout on the huge uncertainty that surrounds excess death estimates.

So, for example, an estimate of an estimate of 98,000 excess deaths with an uncertainty interval of 8,000 deaths to 194,000 deaths is rendered as, simply, 98,000 excess deaths.

Point 3 is central to what follows.

OK, let’s turn to the problems with the standard method for measuring non-violent deaths causes indirectly by war.

The standard approach proceeds as follows, using sample surveys for measurement and null hypothesis significance testing (NHST) to screen results.

1. Estimate a pre-war death rate for violent and non-violent deaths combined.

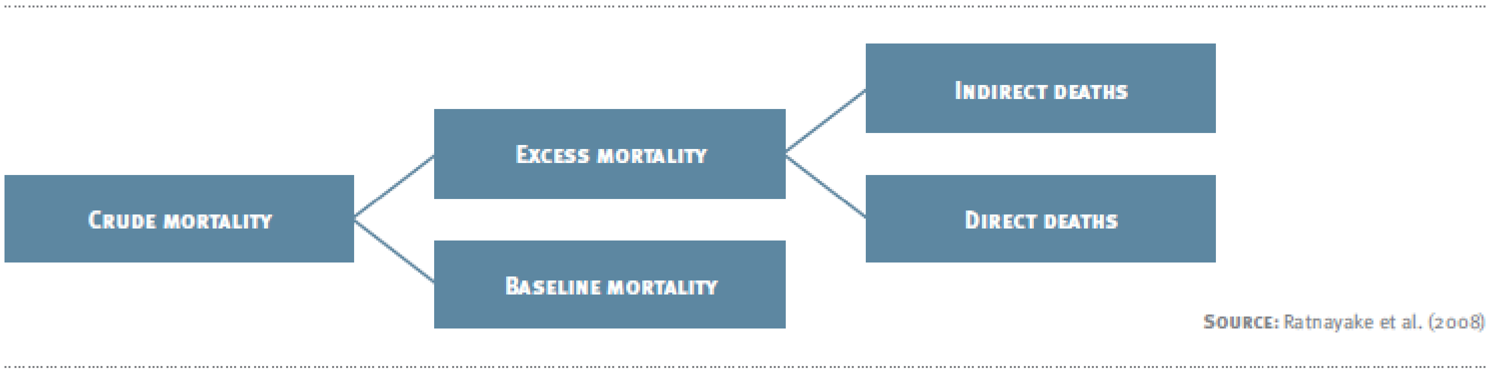
2. Estimate a during-war death rate for violent and non-violent deaths combined.

3. Subtract the pre-war death rate from the during-war deaths rate to find what is called the *excess death rate*.

(4. Assume that this difference (during-war minus pre-war) is *caused* by the war.)

5. Separate excess deaths into violent and non-violent components.

Here's a little graphical representation (not mine) of this procedure:



You subtract baseline mortality from crude mortality to get excess mortality where baseline mortality is usually, but not always, a pre-war level.

You subtract violent (direct) mortality from excess mortality to get non-violent (indirect) mortality.

Step 4, the one about cause and effect, isn’t central to today’s talk but it’s an important and underappreciated step so let’s pause on it briefly.

It’s a logical fallacy (*post hoc ergo propter hoc*) to conclude that A causes B just because B follows A – think of assuming that your alarm clock causes the sun to rise because the sun always rises after your alarm clock rings.

My point is that it’s fine to report an excess death rate but to argue that war has *caused* the change from the pre-war to the during-war rate requires you to *make a case* for such causality, not just blithely assume it.

The main thing I want to highlight here is the way that violent and non-violent deaths are unnecessarily conflated early in the standard calculation and then separated later.

This indirect method to estimate indirect deaths creates distortions and suppresses the uncertainty surrounding estimates - although this method can have benefits under some conditions.

We propose an alternative that method that addresses these issues.

Remember – our objects of study are *non-violent* deaths *indirectly* caused by war.

Therefore, it is strange to begin such a calculation by mixing in violent deaths with non-violent ones.

The standard method ultimately separates the two types of deaths from each other, but why start with conflation only to later undo this conflation?

At a minimum, the standard method is awkwardly roundabout – but the problems go beyond awkwardness.

Now we need to note two more key points.

1. There will be an uncertainty interval (UI) surrounding any decent estimate for an excess death rate.

2. Typically, estimates are screened for statistical significance using NHST – this means in practice that people attach a lot of importance to whether or not the bottom of the UI is above or below 0.

The NHST paradigm is a big part of the problem we highlight in our paper and we should not blindly trap ourselves within its boundaries but in what follows I will largely take it as given.

Consider a simple numerical example (extending through slide 18)

I distinguish between *true* underlying rates and *estimates* of these true rates (that include uncertainty intervals which I will provide when they are germane to the argument).

True Rates

True pre-war non-violent death rate – 6 per 1,000 per

True during-war non-violent death rate – 6 per 1,000 per year

True violent pre-war death rate – 0

True violent during-war death rate – 5 per 1,000 per year

True excess death rate – 5 per 1,000 per year (11 – 6) – *all violent*

True non-violent excess death rate (new concept) - 0 (6 – 6)

Estimates

Estimated pre-war non-violent death rate – 5 per 1,000 per

Estimated during-war non-violent death rate – 7 per 1,000 per year

Estimated violent pre-war death rate – 0

Estimated violent during-war death rate – 5 per 1,000 per year

Estimated excess death rate – 7 per 1,000 per year – UI runs from 2 to 12

Estimated non-violent excess death rate - 2 per 1,000 per year - UI runs from -3 to 7

The Standard (Indirect) Method

The excess deaths estimate passes the statistical significance screen because the bottom of the UI is greater than 0 (from the last slide the bottom of the UI is +2)

We separate out the non-violent component of excess deaths by subtracting the violent death estimate (5) from the excess death estimate (7).

We report the estimate non-violent excess death rate of 2 without an uncertainty interval – the suppression of uncertainty is pretty much mandated by the route we took to arrive at the estimate.

Our Proposed (Direct) Method

Estimate the non-violent excess death rate – 2 per 1,000 per year - UI runs from -3 to 7

Report that this estimate does not clear the statistical significance bar, following the NHST paradigm.

Personally, I would report the UI, note that the bottom is well below 0, say that the non-violent excess death rate is probably positive but that there is a lot of uncertainty (This is another discussion.)

In this example the true non-violent excess death rate is 0 (slide 15) so the direct method does better than the indirect one – moreover, it is easy to see that the story would be similar for non-violent excess death rates near to, but not equal to, 0.

Weaknesses of the Standard (Indirect) Approach Relative to the Direct Approach

1. It’s more ***complicated***

2. It ***doesn’t give you a UI***

3. It **l*owers the statistical significance bar*** - mixing in violent deaths pulls estimates away from 0 – thus it’s prone to overestimation.

4. It ***chases noise*** – random fluctuations in estimates are treated as real movements without uncertainty intervals.

The problems I've been describing are not just theoretical.

A famous estimate of half a million excess deaths in Iraq falls almost exactly into the trap described by the above numerical example (see this, this and this):

1. The authors claim, using the indirect method, that 40% of their excess death estimate is non-violent deaths.

2. They give no UI for excess non-violent deaths.

3. But direct estimation of non-violent excess deaths leads to a UI of -210,000 to 410,000.

We now develop these ideas with some simulations.

In particular, we set up a bunch of simulated war-ravaged countries with varying true death rates (violent, non-violent, pre-war, during-war)

We always set the pre-war violent death rate to 0 and the during-war violent death rate to 5.

The excess non-violent death rates range from -2.4 to +2.7 – note that negative non-violent excess death rates are possible in theory and occur in practice.

We then simulate measurements of all the death rates using household surveys of varying sizes and using both methods, direct and indirect, and compare the results.

Remember that for each simulation we, as analysts, know the true mortality rates because we construct our own artificial universe.

So what follows is analogous to learning how a new weight measurement device performs by testing it on objects with known weights.

We reset estimates to 0 whenever we get a statistically insignificant result, i.e, an uncertainty interval that cuts through 0 – this is an extreme procedure but it's broadly in line with how classical statistics seems to operate in practice.

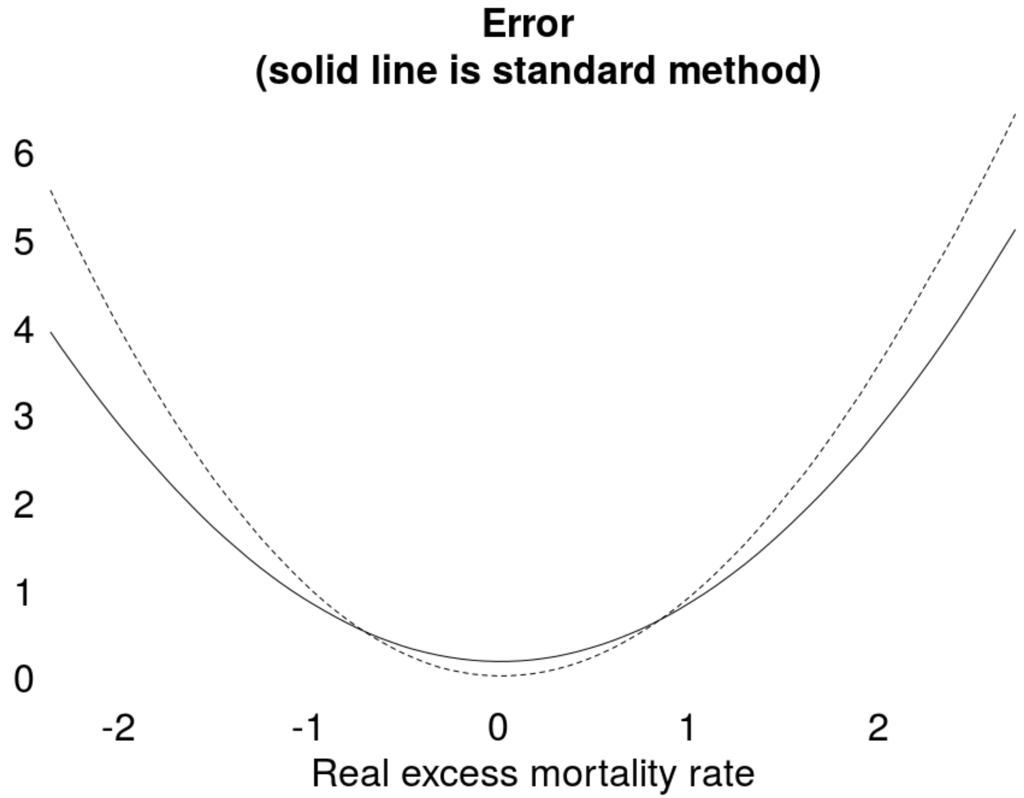
We then measure the deviations of our estimates from the truth.

The following pictures display ***mean-squared errors***, ranging over 1,000 simulated surveys, on the ***Y axes*** and ***true non-violent excess death rates*** on the ***X axes***.

Below we compare surveys with sample sizes of 100 which is not such a small sample size since many such surveys are cluster surveys with 100 or fewer clusters.

The direct method strongly outperforms the (standard) indirect method.

Here are results for sample sizes of 2,000 – a very large number of clusters.



Now the indirect method only outperforms the direct method for non-violent excess death rates that are close enough to 0.

Let’s step back a bit so we can reflect and learn.

Caveat - We’ve made only fairly weak efforts to calibrate our simulations with reality so please don’t take the exact numbers too seriously, e.g., where the two curves cross.

Remember that we set insignificant estimates equal to 0 and note that the direct method will produce insignificant results more frequently than the direct method will because direct estimates are not shifted upwards by violent deaths.

Thus, we are left with the basic trade-off between the two estimates.

1. The ***indirect estimates vary more in response to sampling errors than the direct ones do.***

The smaller the sample size the more the indirect estimates bounce around spuriously in response to sampling errors.

The direct estimates are less variable because they have a stronger anchor at 0

2. The ***direct approach runs higher risks than the indirect approach does of spuriously landing on 0 when there truly are non-violent excess deaths (possibly negative).***

With large sample sizes and a real quantity of non-violent excess deaths the indirect approach will almost always get a statistically significant result because of the boost from violent deaths.

Without the violent-death boost the direct approach may not may not get a statistically significant result in these cases.

We need to think more deeply about how to interpret estimates with uncertainty intervals.

Our calculations convert uncertainty intervals that cross 0 into estimates of 0 non-violent excess deaths – this is, perhaps, a decent starting point but not an ideal finishing point.

At the same time, the standard practice of air brushing away virtually all uncertainty from non-violent excess death estimates, once they cross a statistical significance threshold for violent and non-violent deaths combined, is inappropriate.

Provisional Conclusions

Estimating a non-violent excess death-rate complete with a UI should be a mandatory part of assessments of non-violent deaths indirectly potentially caused by war.

There may still be some value in estimating traditional excess death rates with UI's - that is, we can simultaneously apply the standard indirect method as well as our proposed direct method.

However, ***we should ban the manoeuvre of saying that X percent of a standard excess-death estimate is non-violent and then treating this non-violent portion as a sure thing***.